24510

Potential Flooding

City of Homer

Kenai Peninsula Borough, Alaska

Prepared by the

U.S. Department of Agriculture
Soil Conservation Service
Anchorage, Alaska

In cooperation with the

City of Homer
Kenai Peninsula Borough

Homer Soil Conservation Sub-District
Division of Agriculture, Department of Natural Resources

Division of Lands, Department of Natural Resources
State of Alaska

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PREFACE

This report presents information on runoff problems in the natural drainage ways in the City of Homer, Kenai Peninsula Borough, Alaska.

The purpose is to describe the problems and provide data which will be used in developing and implementing a master drainage plan. Included in the report are information on past floods, flood potential, drainage problems, landslide potential, drainage area maps, hydrologic and hydraulic data, and recommendations for reducing potential drainage and flooding problems in the study area.

The Soil Conservation Service conducted the technical studies and prepared the report. These services were carried out as recommended by the March 1976 Plan of Study, as amended.

The assistance and cooperation provided by the City of Homer, the Kenai Peninsula Borough Planning Department, the Homer Soil Conservation Sub-District, and the Division of Lands, Department of Natural Resources, are appreciated and gratefully acknowledged.

The survey, hydrologic, hydraulic, and other pertinent data are on file with the U.S. Department of Agriculture, Soil Conservation Service, 2221 E. Northern Lights Blvd., Suite 129, Anchorage, Alaska 99504 (Phone: 276-4246).

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INTRODUCTION

This report presents the results of a study on the flood hazard potential in the City of Homer, Alaska. It was prepared by the U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the City of Homer, Kenai Peninsula Borough, the Homer Soil Conservation Sub-District, and the Division of Lands, Department of Natural Resources, State of Alaska.

Knowledge of potential flooding is important in land use planning and the need for adequate storm sewers and floodways has been recognized by city, borough and state officials. The Division of Lands, Department of Natural Resources is especially interested in local planning efforts to assure that management and disposal of state lands is compatible with proposed developments.

Purpose of this report is to describe and illustrate the problems related to natural hazards from runoff within the city limits of Homer. It contains information on past floods, drainage problems, maps, engineering and hydrologic data. The data should be useful to the City in developing a master drainage plan, in road and culvert design, and drainage channel modification. Recommendations to reduce damages from potential flooding are included; however, it is beyond the scope of this study to provide specific proposals or designs to rectify the flooding problems.

The request for this study was by the Homer City Coucil through the Homer Soil Conservation Sub-District in October 1975. Originally, the area of study covered the southwest Kenai Peninsula. It was later determined that it would be beneficial to complete analyses of the City of Homer separately. The "Plan of Study" for the Flood Hazard Analyses of the City of Homer was accepted by the City Council in January 1976. The Division of Lands, Department of Natural Resources, State of Alaska, establishes priorities for flood plain and flood hazard studies and coordinates study requests by local, state, and federal agencies to avoid duplications. The Division of Lands and the Soil Conservation Service entered into a joint coordination agreement for flood hazard studies in June 1975.

Flood hazard studies are carried out by the Soil Conservation Service as an outgrowth of the recommendations in <u>A Report by the Task Force on Federal Flood Control Policy</u>, House Document No. 465 (89th Congress, August 10, 1966), especially Recommendation 9(c), <u>Regulation of Land Use</u>,

Early residents in the study area were Athabascan Indians followed by Russian explorers in the mid-1700's. The City of Homer has evolved from a settlement on the Homer Spit established by a gold mining interest in 1898. Gold mining was unprofitable, but coal was easily obtainable and two coal mines along with fishing were the main ventures contributing to growth of the settlement. Commerical fishing gained momentum in the 1920's when boats owned by canneries began fishing in Kachemak Bay. Homesteaders settled in the Homer vicinity in the 1930's and again following World War II when the Sterling Highway was constructed. Farming has generally not been a successful enterprise and many of the homesteaders earned part of their living by fishing, logging, trapping, working in canneries, and construction work. Many of the old homesteads are now being subdivided into building lots.

The population of Homer in 1960 was 1,247 people; 1,083 in 1970; and 1,548 in 1975. Based on building permit applications, the estimated population in July 1977 was 1,802 people. Fishing and fish processing are the major industries with government and tourism contributing to the economy. The demand for housing has increased and the current trend towards residential development is expanding rapidly. Homer is a very popular tourist area and several building sites are being sold for vacation homes to residents of Anchorage and other Alaskan communities. The nearby logging and oil developments could also have significant impact on the future growth of Homer.

Approximately 80 percent of the land within the city limits, in 1977, was undeveloped, and attention is drawn to soil characteristics that may limit construction. Principal soil limitations in the Homer area include poor drainage, low permeability, and susceptibility to frost action. Some of the land is not suitable for building sites or road construction because of extremely steep slopes.

FLOOD HISTORY

Homer has not experienced the widespread and destructive water flow that is usually thought of as flooding. Small areas along streams have flooded when ice formed on the channel bottom, filled the channel, and crowded the flow onto adjacent land. This process is called aufeis and is common in arctic and subarctic streams that are fed by springs. A study of natural hazard problems at Homer made by Sandra Stringer from the Scotial Group, Fairbanks, Alaska, in 1976, found that aufeis is the principal cause of flooding. A search of archival information revealed very little concerning dollar damages of flooding.

Historically, flooding has been more of a nuisance than a hazard to life and property.

FLOOD POTENTIAL

Future flooding is expected to be very similar to past flooding, but it could be more severe if trees, brush, coal, floating ice, and/or other debris blocked a drainage way very suddenly. Residents would have less time to respond than in the case of aufeis flooding. Flood damage can increase greatly if damageable facilities are constructed in areas subject to flooding, or if stream crossings restrict the movement of water and possible debris.

FUTURE CONDITIONS

Future flood conditions will be affected significantly by population growth and the tendency to encroach upon drainage ways.

The population in 1983 is projected to be between 3,400 and 5,000 depending upon the impact of oil activity. With the increased number of homes, businesses, and streets, drainage way overflows that were nuisances in the past could have significant economic and social impact.

The actual extent of flooding and seriousness of damage will depend largely upon the degree of encroachment into the naturally flooded areas, the adequacy of road crossing and other structures over the drainage ways, and the engineering design of buildings that may be affected by overflows.

DRAINAGE WAY MANAGEMENT

The need for an adequate system of drainage ways has been recognized by city and borough officials. One of the many problems confronting the development of residential and adjoining areas is that of systematically conveying runoff from one locale to another and finally to a safe point of disposal. Information developed for this report and described in the section, "Investigations, Analyses, and Technical Data," should be useful in developing a master storm drain plan.

At present there are no city ordinances specifically for drainage ways; however, ordinances relating to driveways and streets are important in relation to storm drainage. The following are Articles and Sections pertinent to drainage:

Code of Ordinances - City of Homer, Alaska

Article IV, Driveway and Right-of-Way Construction Permits

Section 14-400. g. Application for Permits

(a) Driveways, Approaches. - The application must be accompanied by a plan showing complete details on drainage: All driveways and

buffer areas should be constructed so as not to impair the drainage within the street or road right-of-way nor alter the stability of the roadway subgrade and at the same time not impair or materially alter drainage of the adjacent areas. All culverts, catch basins, drainage channels, and other drainage structures required within the buffer area and under driveways as the result of the property being developed, shall be installed in accordance with the standards set by the city, said standard being available at City Hall.

Article V, Standards for Street Construction

Section 14,500-4. Culverts

A. Cross Culverts

1. Shall be sized for stream flow based on a 25-year flood.

2. Shall be 18 inch minimum inside diameter.

B. Driveway Culverts

1. Shall be 18 inch minimum diameter.

2. Minimum length shall be 21 feet - maximum length 35 feet.

a. Special conditions requiring longer culvert lengths will be subject to the approval of the Public Works Director.

3. Driveway elevation at road ditch line shall be 0.1 foot below the elevation of the edge of shoulder.

4. Driveway ditches shall be constructed in such a manner so that no scour will occur to road ditch.

Plat approvals for subdivisions are under the jurisdiction and provisions of the Kenai Peninsula Borough Planning Commission. In respect to storm water overflow and proposed drainage requirements for preliminary plats, chapter 20.12, sections 20.12.060 and 20.12.070 of the provisions are as follows:

<u>Kenai Peninsula Borough Planning Commission - Provisions</u>

Chapter 20.12 Preliminary Plats

Section 20.12.06 Form and Contents required.

The preliminary plat shall be drawn to scale of sufficient size to be clearly legible and shall show the following:

O. Approximate locations of areas subject to inundation or storm water overflow; the location, width, and direction

of the flow of watercourses; and if adjacent to tidewater, the line of high water.

Section 20.12.070 Statement required when -- Contents

Information which cannot be practically shown on the plat shall be presented in a written statement together with the following information:

A. Proposed drainage and flood-control measures.

Flood Insurance

The Kenai Peninsula Borough is participating in the U.S. Department of Housing and Urban Development's National Flood Insurance Program, administered by the Federal Insurance Administration (FIA). Flood insurance is available to owners and occupiers of all buildings, mobile homes, and their contents, throughout the Borough.

The Alaska District, U.S. Army Corps of Engineers, has carried out flood insurance studies on several Borough communities, including portions of Homer. Flood insurance studies generally exclude areas in which flooding problems are due to inadequate drainage.

For the purpose of the flood insurance program, flooding from inadequate drainage relates to the two following conditions:

1. Flooding which results solely from backwater from a man-made structure or channel which is of insufficient size. Typically, such structures include culverts, conduits, storm sewers, drainage ditches and completely piped watercourses, which are limited to use on relatively small drainage areas. Generally, flooding from this source would be limited to ponding in flat areas, or sheet flow where slopes are greater, and no structural damage would be expected in undeveloped areas.

2. Flooding from any source where the drainage area is less than one square mile in size. The volume of water generated from areas of this size is generally insufficient to produce more than shallow flooding and no strucutral damage would be expected. The installation of adequate drainage networks during development should eliminate this type of flooding.

Even though the FIA generally does not carry out detailed hydraulic studies in areas where flooding is due to inadequate drainage, this does not preclude the sale of flood insurance in those areas.

Structural Flood Control Measures

Structural measures commonly used to alleviate flooding in storm drainage systems include: open and covered storm sewers, road ditches and culverts,

landgrading and earth fills for buildings, storm water holding ponds, and sediment catchment basins.

In the past, runoff in Homer has been conveyed through road ditches, culverts, and natural drainage ways. With considerable development, drainage problems will increase and there will be a need for a comprehensive and effective drainage system. Important features of that drainage plan must be means to control erosion and stabilize the drainage ways.

Recommendations

The following recommendations are included for consideration in reducing potential flood damage.

1. The City of Homer should develop a master drainage plan for all watersheds draining through it.

2. The City of Homer should submit the drainage plan to the Kenai Peninsula Planning Commission and assembly for consideration and approval.

3. Storm drainage ordinances for existing and new developments should be enacted and implemented.

4. Dedicated rights-of-way for storm drains compatible with the master drainage plan should be a requirement for each new subdivision plat and single development building permits.

5. Several existing road crossings obstruct flows during periods of storm runoff. Remedial measures to existing obstructions, and future road crossing design and locations should be compatible with the master drainage plan.

6. Road and street systems in new developments should run parallel to natural drainage ways with a minimum number of roads crossing the drainage ways.

7. To preserve the natural beauty and aesthetic values, the larger natural drainage ways which convey the major runoff should be preserved and utilized in conjunction with constructed storm drains.

8. All drainage ways, either natural or constructed, that are designated as part of the master drainage plans should be city owned.

9. Conduct periodic inspections and implement a drainage way maintenance program to remove debris and repair damaged channels and structures.

INVESTIGATIONS, ANALYSES, AND TECHNICAL DATA

Study Investigations and Analytical Results

The natural drainage ways were analyzed for storm runoff carrying capacitites. Results of the study show that the 100-year return period rainstorm runoff is within channel flow in unobstructed natural drainage ways; therefore, it was not possible to delineate the 100-year flood plain. Essentially, the main storm runoff problem is due to inadequate drainage caused by drainage way obstructions such as road crossings which restrict the hydraulic capacity and which are aggravated by aufeis, sediment, and debris.

In the Code of Ordinances for the City of Homer, the standards for cross culverts in street construction specify the culverts "shall be sized for streamflow based on the 25-year flood."

Erosion, sediment, and potential landslide problems are of particular importance in the steep bluff and escarpment areas. These areas are mapped and designated in the published Soil Conservation Service Soil Survey. Erosion in these areas is severe and soil limitations for road and building contruction are very severe. Detailed geologic and engineering investigations are recommended for all areas in which development is likely to occur.

Maps and Aerial Photographs

Maps used for the study include: USGS topographic quadrangle sheets, Seldovia (C-4) and (C-5)(scale 1:63,360), and topographic maps for Homer, Alaska (scale 1" = 200'), with 5' contours. The topographic maps, published in January 1970, were developed by SCS using stereophotogrammetric methods and 1968 aerial photography. These maps were reduced to a scale of 1" = 500' for report purposes. Stereo copies of aerial photography at scales of 1" = 1000' and 1" = 500', produced by North Pacific Aerial Surveys, Inc., Anchorage, Alaska, were used to determine the drainage areas north of and leading into the city limits of Homer. Drainage areas were measured on the topographic maps.

Surveys

Engineering field surveys to determine cross-sectional areas at various points along several natural drainages were conducted by SCS contract with Ability Surveys, Homer, Alaska, during the summer of 1977. The survey data and SCS topographic maps were used in the hydrology and hydraulic analyses.

Watersheds

The study area is disected by several natural drainage ways. Because of the dense cover of trees, brush, and other vegetation, many of the

drainage ways are obscured from view. One of the values of topographic mapping is that the size and direction of flow of the watercourses can be located in relation to existing and proposed developments. Only three of the drainage ways are identified by name: Bidarki Creek, Woodward Canyon, and Palmer Creek. There are numerous other drainage ways which are important in respect to storm drainage planning. For purposes of this study and also for use in the master drainage plan, the study area was delineated into 28 separate watersheds. The watersheds have been named and numbered and drainage areas measured. Larger drainage ways within the watersheds have been numbered using a decimal point system. As the master drainage plan is developed, the smaller drains can be designated by continuing the decimal point numbering system. Watershed delineations are on the photographic map attachments to this report. Watershed designations, photographic map locations, and drainage areas are shown on Table 1 - Watershed Drainage Areas.

Hydrology and Hydraulics

Peak discharge was estimated for a range of drainage areas and for storms of several return intervals utilizing procedures of SCS Technical Release 55 "Urban Hydrology for Small Watersheds," Section 4 of National Engineering Handbook, and precipitation data from Homer Airport.

Figure 1 displays the discharge-drainage area-return interval relationship and can be used to estimate peak discharge for culvert design and other purposes.

Landslide Potential

The steep bluffs on the northern city limits and the upper drainage areas of the Palmer Creek Watershed (north of and outside the city limits) are of particular concern in respect to storm drain management. These areas are the source of sediments and debris that are eroded and washed downstream during periods of storm runoff and caused clogging and maintenance problems in the drainage ways. Human disturbance of the bluff areas can increase the potential of landslides. When vegetation is removed, the natural slopes steepened or lengthened or weighted with fills and structures, the soil mass is weakened and landslides can occur. These areas could be vulnerable to sliding during periods of storm runoff and earthquakes even though stability was not noted as a problem before human disturbance.

Detailed geologic and engineering investigations are suggested for the entire bluff area where future developments are likely to take place. Results of the studies can then be used for ordinances and regulations to control construction practices in the locales of potential landslide problems.

TABLE 1

Watershed Drainage Areas

Watershed	Total Drainage Area (Acres)
Baycrest 1.00	105
Sterling 2.01 SH	27
Sterling 2.02	107
Sterling 2.02 NH	7
Sterling 2.03	120
Sterling 2.04	142
Bidarki Cr. 3.01	282
West Hill 4.00	608
School 5.00	144
Woodward Canyon 6.01	399
Woodward Canyon 6.02	97
Pioneer 7.01	596
Pioneer 7.02	235
Pioneer 7.03	140
Pioneer 7.04	116
East Hill 8.01	177
East Hill 8.01 NH	43
East Hill 8.01 SH	37
East Hill 8.02	232
East Hill 8.03	100
East Hill 8.04	191
East Hill 8.05	136
East Hill 8.06	86
East Hill 8.07	115
East Hill 8.08	120
Palmer Cr. 9.01	827
Palmer Cr. 9.02	440
TOTAL	5,629

Soil Surveys

The soil survey for Homer - Ninilchik Area was published by the USDA - Soil Conservation Service in 1971. It includes soil descriptions and information on geology, climate, vegetation, and agricultural uses of soils. A more detailed survey for the City of Homer has been recently completed and was prepared especially for urban planning.

Of special interest, is the information on the engineering application of soils. The report information, together with soil maps and descriptions can be used to determine soil conditions that are significant to construction. This does not eliminate the need for sampling and testing at specific site locations; however, the soil maps and engineering interpretations can be used in planning more detailed investigations in respect to the types of construction problems that may be encountered.

Information regarding the soil surveys can be obtained by contacting the Soil Conservation Service, 2221 E. Northern Lights Blvd., Suite 129, Anchorage, Alaska 99504, or the Homer Soil Conservation Sub-District Field Office, P.O. Box 415, Homer, Alaska 99603.

GLOSSARY OF TERMS

Aufeis - The formation of ice by successive layers of water freezing over existing ice.

Drainage way - A route or course along which water moves or may move to drain a region.

Channel - A natural or artificial watercourse of perceptible extent with definite banks to confine and conduct continuously or periodically flowing water. Channel flow is that water which is flowing within the limits of the defined channel.

Flood - Water from a river, stream, watercourse, lake or other body of standing water, that temporarily overlows the boundaries within which it is ordinarily confined.

Flood Peak - The highest stage or discharge attained during a flood event; also referred to as peak stage or peak discharge.

Flood Plain - The relatively flat or low land area adjoining a river, stream, watercourse, lake, or other body of standing water which has been or may be covered temporarily by flood water. For regulatory purposes, the federally accepted flood plain has been defined as the area that would be inundated by the 100-year flood.

Landslide - A downhill movement of earth, rock, or mud.

Recurrence Interval - The average time interval between actual occurences of a hydrological event of a given or greater magnitude.

Runoff - That part of precipitation, as well as any other flow contributions, which appears in surface streams of either perennial or intermittent form.

Stormsewer - Open or enclosed channels, drainage ways, and conduits constructed especially to convey runoff.

Stream - Any natural channel or depression through which water flows either continuously, intermittently, or periodically, including modification of the natural channel or depression.

Structure - Anything constructed or erected, the use of which requires a more or less permanent location on or in the ground. Includes but is not limited to bridges, buildings, canals, dams, ditches, diversions, irrigation systems, pumps, pipelines, railroads, roads, sewage disposal systems, underground conduits, water supply systems, and wells.

Watershed - A drainage basin or area which collects runoff and transmits it usually by means of streams and tributaries to the outlet of the basin.

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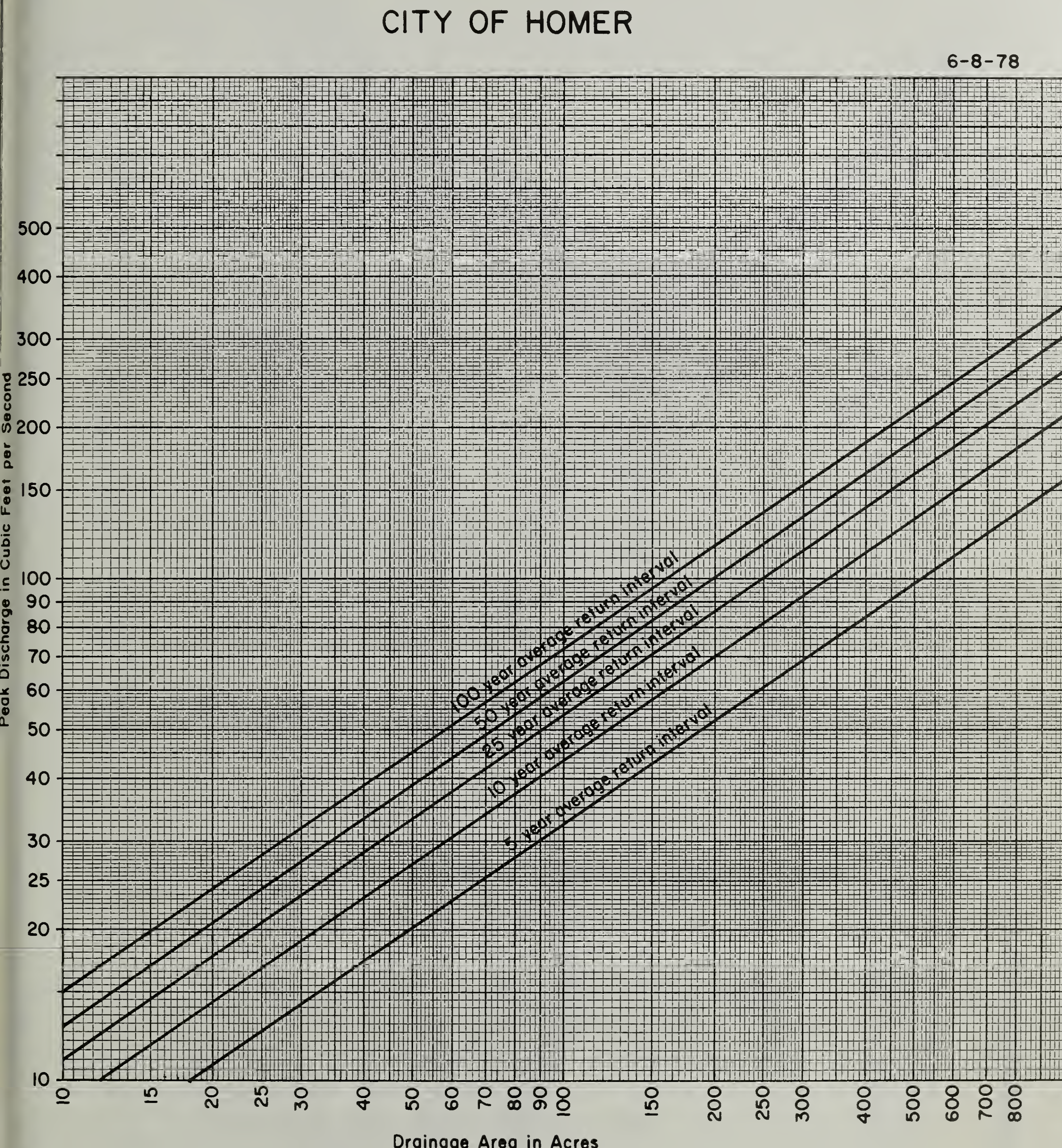
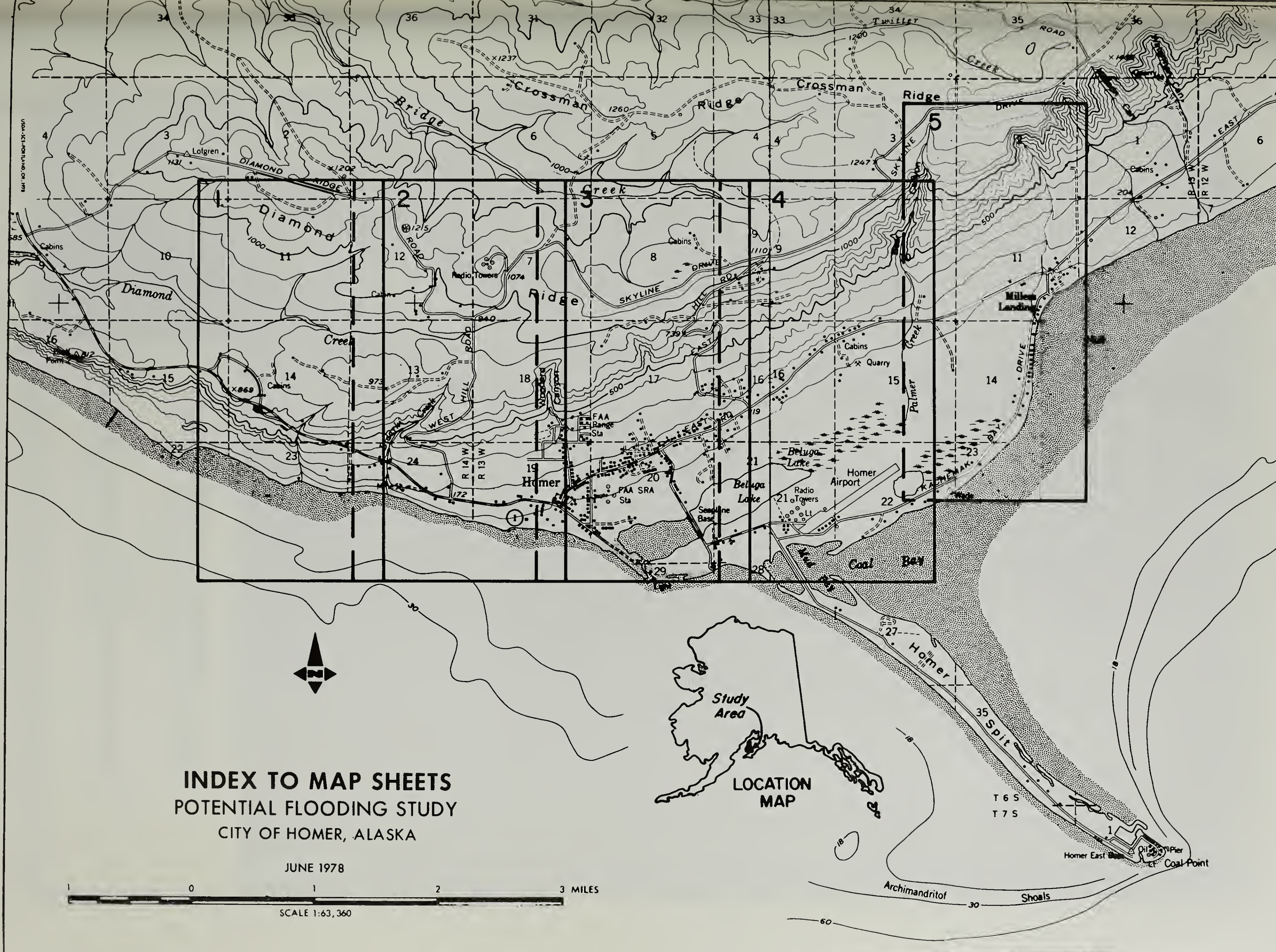


Figure I. Relationship of peak discharge to drainage area and average return interval at Homer, Alaska.



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POTENTIAL FLOODING STUDY
CITY OF HOMER, ALASKA

JUNE 1978

1 0 1 2 3 MILES

SCALE 1:63,360

Source
Map prepared by SCS, WTSC Carto Staff from state staff compilation.
Photo base prepared from 1968 1:12,000 photography.
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

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